

Application No. 09/896,224
Amendment dated March 1, 2004
Reply to Office Action dated November 20, 2003

Amendments to the Claims

This Listing of Claims replaces all prior versions and Listings of Claims in the application:

Listing of Claims:

Claim 1. (Currently Amended) A crude oil ~~desulfurization~~ desulfurization process comprising the following steps:

- (a) hydrodesulfurizing a crude oil feed in a crude desulfurization unit to obtain a desulfurized crude oil;
- (b) separating the desulfurized crude oil of step (a) into a light gas oil fraction, a vacuum gas oil fraction and a residual fraction;
- (c) hydrocracking the vacuum gas oil fraction of step (b) into at least one fuel product having a low sulfur content; by means of the following steps:
 - (1) passing the vacuum gas oil in combination with hydrogen to a first hydrocracking reaction zone to create an effluent comprising at least one fuel product having a low sulfur content;
 - (2) passing at least a portion of the effluent of, step (1) to a second hydrocracking reaction zone; and

- (3) recycling at least a portion of the second hydrocracking reaction zone effluent to the second hydrocracking reaction zone.
- (d) hydrotreating the light gas oil fraction of step (b).

Claim 2. (Canceled)

- Claim 2 3. (Currently Amended) The process according to Claim 1 wherein the second hydrocracking reaction zone ~~of claim 1(c) step 2~~ further comprises a multiplicity of layered catalyst beds, including at least one hydrotreating catalyst layer which is maintained at reaction conditions preselected for high hydrotreating activity.
- Claim 3 4. (Currently Amended) The process according to Claim 3 wherein the second hydrocracking reaction zone ~~of claim 1 (c), step 2~~ further comprises at least one hydrocracking catalyst layer which is maintained at hydrocracking reaction conditions, such that the entire effluent from the catalyst layer maintained at hydrocracking reaction conditions passes to the catalyst layer maintained at hydrotreating reaction conditions.
- Claim [4] 5. (Currently Amended) The process according to Claim 4, which further comprises fractionating at least a portion of the effluent from the second hydrocracking reaction zone ~~of claim 1 (c), step 2~~ and isolating at least one fuel product and a recycle stream which is recycled to the second hydrocracking reaction zone ~~of claim 1(c), step 2~~.

Claim 5 6. (Currently Amended) The process according to Claim 3 wherein
~~claim 1 (d)~~ further comprises comprising passing the light gas oil
fraction to the hydrotreating catalyst layer.

Claim 6 7. (Currently Amended) The process according to Claim 1, wherein
~~claim 1 (c)~~ further comprises isolating at least a diesel having a
low sulfur content, a kerosene having a low sulfur content, and a
naphtha having a low sulfur content.

Claim 7 8. (Currently Amended) The process according to Claim 1 ~~(e)~~ step
(1) wherein (c) further comprising comprises:

(a) ~~hydrocracking the vacuum gas oil to form a first~~
~~hydrocracking zone effluent;~~

(b) passing the first hydrocracking zone effluent to a
hot hydrogen stripper and isolating a first
hydrogen-rich gaseous stream and effluent having
a low-sulfur effluent[;] and

(e) passing the first hydrogen-rich gaseous stream of
~~step (b)~~ to the crude desulfurization unit for
hydrodesulfurizing the crude oil feed.

Claim 8 9. (Currently Amended) The process according to Claim 3 further
comprising[:]

(a) ~~hydrocracking the vacuum gas oil according to~~
~~claim 1 (e) step (1) to form a hydrocracking zone~~
~~effluent;~~

(b) passing the first hydrocracking zone effluent to a
hot hydrogen stripper and isolating a hydrogen-rich

gaseous stream and effluent having a low sulfur content[;] and

- (e) passing the first hydrogen-rich gaseous stream to the crude desulfurization unit for hydrodesulfurizing the crude oil feed.

Claim 9 10. (Currently Amended) The process according to Claim 9, which further comprises:

- a) passing the low-sulfur effluent of ~~claim 9 (b)~~, in combination with hydrogen to the second hydrocracking zone of ~~claim 1 (c), step 2~~ to produce a hydrocracked liquid product; and
- b) fractionating the hydrocracked liquid product to form at least one fuel product having a low sulfur content.

Claim 10 11. (Currently Amended) The process of Claim 10, further comprising passing the low sulfur effluent of claim 9 (b), to the hydrotreating catalyst layer of ~~Claim 6~~.

Claim 11 12. (Currently Amended) The process according to Claim 1 wherein ~~Claim 1 (b), which recites separating the desulfurized crude oil step (b)~~ further comprises:

- (a) separating the desulfurized crude oil in an atmospheric distillation column and isolating at least a light gas oil and an atmospheric residuum therefrom[;].

- (b) separating the atmospheric residuum of step (a) in a vacuum distillation column and isolating at least a vacuum residuum stream and a vacuum gas oil stream.

Claim 42 13. (Currently Amended) The process according to Claim 8 wherein the first hydrocracking zone effluent ~~of Claim 8-(a)~~, is passed to a second hydrocracking reaction zone without substantially cooling the first hydrocracking zone effluent.

Claim 43 14. (Currently Amended) A crude oil desulfurization process comprising:

- (a) hydrodesulfurizing a crude oil feed in a crude desulfurization unit to obtain a desulfurized crude oil;
- (b) separating the desulfurized crude oil ~~of claim 14-(a)~~ and isolating a light gas oil fraction, a vacuum gas oil fraction and a residual fraction;
- (c) passing the vacuum gas oil ~~of claim 14-(b)~~, in combination with hydrogen to a first hydrocracking reaction zone, where it is hydrocracked to produce a first hydrocracking zone effluent;
- (d) passing at least a portion of the first hydrocracking zone effluent ~~of claim 14-(c)~~, to a second hydrocracking reaction zone comprising a multiplicity of catalyst beds, including at least one hydrotreating catalyst layer which contains catalyst preselected for high hydrotreating activity;

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- (e) passing the light gas oil fraction of ~~claim 14 (b)~~,
step (d) to the hydrotreating catalyst layer of step
(d) for hydrotreating the light gas oil fraction; and
- (f) recycling at least a portion of the combined
effluent of ~~claim 14, steps (d) and (e)~~ to the
second hydrocracking reaction zone.